

### **Door Panel assembly**

The present invention relates to door panel assemblies and in particular door panel assemblies of land vehicles such as cars (automobiles).

Known cars include doors having windows. It is possible to lower and raise a window glass in order to open and close the window. The vertical position of the window glass is controlled by a window regulator, parts of which are generally secured to a lower edge of the window glass.

Several different forms of window regulator are known.

The window glass and window regulator are positioned in a cavity within the door and are attached to one side (the "wet" side) of a door panel. The window regulator is driven by components within a window regulator housing mounted on the wet side of the door panel.

A power mechanism is attached to the other side (the "dry" side) of the door panel opposite to, and in driving co-operation with the window regulator housing. The power mechanism can comprise a manual arrangement or a powered motor arrangement.

A problem with known door panel assemblies is to ensure alignment of the window regulator housing with the power mechanism.

An object of the present invention is to provide an improved form of alignment arrangement. A further object of the present invention is to provide a cheaper form of alignment arrangement.

Thus according to the present invention there is provided a door panel assembly including a door panel, a window regulator housing mounted on a first side of the door panel and a power mechanism mounted on a second side of the door panel, in which the panel includes at least one first alignment feature for aligning the window regulator

housing relative to the door panel and at least one second alignment feature for aligning the power mechanism relative to the door panel.

The invention will now be described, by way of example only, with reference to the accompanying drawings in which:-

Figure 1 is a schematic view of a door panel assembly including a door panel, a window regulator housing, and a motor according to the present invention and

Figures 2, 3, 4, 5 and 6 show differing methods of aligning the three components of figure 1.

Figure 7 shows a method of fixing the door panel and window regulator housing of figure 1

With reference to figure 1 there is shown a door panel assembly 10 including a window regulator housing 12, a door panel 14 and a power mechanism in the form of a window regulator motor 16.

In further embodiments the power mechanism could be in the form of a manual window winder

Door panel 14 can be in the form of a door inner skin, i.e. a pressed component having various holes and attachment features for components such as door hinges, door latch, audio speakers, window regulator motors etc..

Alternatively door panel 14 can be in the form of a door module panel i.e. a panel onto which is pre-mounted various components such as a window regulator motor, an audio speaker, a door latch etc. with this pre-assembled door module being mounted in a relatively large aperture of a door inner skin.

Window regulator housing 12 might typically contain a drum around which has being wound cable, rotation of the drum causing movement of the cable and hence raising or lowering of the window glass via separate components of the window regulator.

Note that the present invention is not restricted to window regulators containing drums with cables.

In particular it should be noted that the arrangement shown in figure 1 enables power generated by the window regulator motor 16 to be transferred across the door panel to the window regulator to enable raising and lowering of the window.

The three components shown in figure 1 can be aligned, according to the present invention, in various ways as shown in figures 2 to 6. For ease of understanding, the reference numerals for the window regulator housing 12, door panel 14 and window regulator motor 16 of figure 1 have been used universally in figures 2 to 6.

Consideration of figure 2 shows that the door panel 14 includes a pressed feature 18, in this case a frustoconical cone. Window regulator housing 12 includes a corresponding frustoconical recess 20 and motor 16 includes a corresponding frustoconical projection 22.

It can be seen that the engagement between recess 20 and the frustoconical cone 18 on the first side 24 of the door panel 14 provides alignment of the window regulator housing 12 with the door panel 14.

Furthermore it can also be seen that engagement between the frustoconical projection 22 and the frustoconical cone 18 on the second side 26 of the door panel 14 provides alignment between the motor 16 and door panel 14.

Thus by providing an accurate alignment method between the motor and door panel and by providing a further accurate alignment method between the window regulator

housing and door panel, it is possible to accurately align the window regulator motor with the window regulator housing.

It can also be seen from figure 2 that the window regulator housing 12, door panel 14 and motor 16 each include a hole 28, 30 and 32 respectively through which passes a bolt 34, on the end of which is secured a nut 36. Tightening of the nut and bolt ensures that the window regulator housing, door panel and motor are tightly clamped together and the nut and bolt (together with other nuts and bolts) ensure that the window regulator housing, door panel and motor are fixed relative to each other.

In particular it can be seen that hole 30 is contiguous with the pressed feature (frustoconical cone 18).

A distinction should be made between those features which align the window regulator housing, door panel and motor (i.e. frustoconical cone 18, frustoconical recess 20 and frustoconical projection 22) and those features which secure the window regulator housing, door panel and motor relative to each other (i.e. the bolt 34 and nut 36 in conjunction with the holes 28, 30 and 32). In further embodiments it is possible to provide alignment feature, such as cones, conical recesses and conical projections, in the absence of fixing features such as holes. Such fixing features can be provided at other positions on the window regulator housing and motor.

In an alternative embodiment it is possible to use a screw which passes through hole 32 and hole 30 and is then screwed directly into the material of the window regulator housing 12. Alternatively a screw can pass through hole 28 and 30 and screw directly into the material of motor 16.

The alternative fixing features could secure both the window regulator housing and motor to the door panel.

Alternatively one set of fixing features can be used to secure the window regulator housing to the door panel and separate set of fixing features can be used to secure the motor to the door panel.

Thus figure 7 shows a door panel 14 having a tab 72 bent out of the general plane of the door panel. The tab 72 has a tang 74, with both the tab and tang being received in a recess 80 of the window regulator housing 12. End 76 of tang 74 engages a hole 78 which is contiguous with the recess 80 to ensure the window regulator housing 12 is fixed relative to the door panel 14. In this case other features of the door panel and window regulator housing provide for alignment of these two components.

Such an arrangement of fixing of the window regulator housing relative to the door panel means that the person assembling the various components can initially assemble the window regulator housing relative to the door panel and then subsequently, and without having to hold the window regulator housing in place, can assemble the motor onto the door panel. It is clear that a similar arrangement of fixings can be used to secure the door panel and window regulator motor.

In yet further embodiments a projection can be provided on the window regulator housing or motor which is inserted and cooperates with a hole in the door panel to fix the window regulator housing or window regulator motor relative to the door panel.

With reference to figure 3 there is shown a door panel 14 in which tabs 38 and 40 have been bent out of the general plane of door panel 14.

Tab 38 is received in recess 42 of the window regulator motor 16 and ensures alignment between the window regulator motor and the door panel 14.

Tab 40 is received in recess 44 of window regulator housing 12 and ensures alignment between window regulator housing 12 and the door panel 14.

In this case both tabs 38 and 40 are contiguous with a hole 46 in the door panel through which a bolt passes, which in conjunction with a nut 50 secures the window regulator housing, door panel and motor.

Consideration of figure 4 shows a dowel 52 which, in this case, is threaded along its whole length.

Note that in further embodiments it is possible to arrange the dowel to be only partially threaded, indeed the complete dowel can be absent of any threaded portions in order to provide alignment of the various components.

A mid portion 54 of dowel 52 is threaded into a corresponding threaded hole in the door panel 14 to secure the dowel 52 to the door panel 14. Holes 58 and 56 in window regulator housing 12 and motor 16 respectively pass over the appropriate ends of the dowel 52 to ensure that the window regulator housing and window regulator motor are aligned correct relative to the door panel 14.

In this case it can be seen that the dowel 52 is further utilised to secure the window regulator housing, door panel and motor since nuts 60 and 62 can be used to tighten the various components.

Consideration of figure 5 shows two distinct dowels 64 and 66 each been threadded on opposing ends with dowel 64 being used to both align and secure window regulator housing 12 relative to door panel 14 and with dowel 66 being used to both align and secure motor 16 relative to door panel 14.

Consideration of figure 6 shows a dowel 68 which has been secured to the window regulator housing 14 by a swaging technique wherein portions 70 of the dowel 68 have been plastically deformed in order that the panel 14 is clamped between these portions.